II NECEDAH NATIONAL WILDLIFE REFUGE

1. HISTORY AND PURPOSE

The history of the Refuge dates back to the early 1930s when the U.S. Government acquired 114,964 acres of land in Juneau, Wood, Monroe, and Jackson Counties, Wisconsin, using the authority of the National Industrial Recovery Act of 1933 and the Emergency Relief Appropriation Act of 1935. The purpose for these acquisitions was to assist farmers living within the area and to develop the area for wildlife.

On March 14, 1939, Franklin D. Roosevelt signed an executive order authorizing 43,696 acres of this Federal land be set aside as the Necedah Migratory Waterfowl Refuge for the purpose of "*a refuge and breeding ground for migratory birds and other wildlife...*" (Executive Order 8065) and "*...for use as an inviolate sanctuary, or for any other purpose, for migratory birds*" (Migratory Bird Conservation Act of 1929).

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One year later, the Necedah Migratory Waterfowl Refuge became formally known as the Necedah National Wildlife Refuge. Around this same time, the management of 55,000 acres of this Federal land was transferred to the State of Wisconsin with the signing of a Cooperative and License Agreement. However, in 1941, Executive Order 8763 declared these federally owned/state managed lands be *"reserved as a refuge and breeding ground for native birds and other wildlife and for research relating to wildlife and associated forest resources, under such conditions of use and administration as will best carry out the purposes of the land conservation and land utilization program for which such lands have been, or are being acquired..."*. Executive Order 8763 also designated the Service as custodial agent for the property.

Today this land is known as Necedah Wildlife Management Area, which includes parts of the Central Wisconsin Conservation Area (parts of Meadow Valley State Wildlife Area, parts of Wood County Wildlife Area, and parts of Sandhill State Wildlife Area) and scattered parcels in Jackson County (Figure 3). They are part of the National Wildlife Refuge System, but managed cooperatively with the Wisconsin DNR through a Cooperative Agreement. It should be noted that this CCP is for the Refuge portion of this land only.

Graphic

2. REFUGE RESOURCE SETTING

2.1 Fish and Wildlife Resources

Regional Fish and Wildlife Conservation Priorities
In 1999, the Great Lakes-Big Rivers Region of the Service initiated a process to identify its top species priorities in terms of those in need of the greatest conservation attention in the Region. The following table (Table 1) is a list of regional priority species that occur on the Refuge and/or the Yellow River Focus Area. In addition, the Refuge and the adjacent Yellow River area contain habitat that supports or historically supported several species of birds on the Service's List of Migratory Nongame Birds of Management Concern. Table 1 contains those species as well. The planning team used this information when developing goals and objectives for the Refuge (Chapter 4).

Birds
For centuries, birds have descended upon the Refuge area during their annual migrations between Central and South America and their northern U.S., Canadian, and Arctic breeding grounds. In total, over 230 different species of birds have been observed on the Refuge since its inception. The Refuge has long been considered an important migratory stopover area for mallards, blue-winged teal, ring-necks, and wood ducks. Other migrant species that utilize the Refuge during spring, summer, or fall include: Canada, snow, and white-fronted geese; sandhill cranes; woodcock; snipe; great blue herons; swans; egrets; dickcissels; warblers; brown thrashers; several different species of sparrows; meadowlarks; sora rails; black-crowned night herons; bobolinks; bitterns; and red-tailed hawks; just to name a few. During migrations, 3 species of geese, 10 species of dabbling ducks, 9 species of diving ducks, and trumpeter and tundra swans are commonly found in significant numbers on the Refuge. Waterfowl are most abundant in the fall, with fall counts of ducks averaging around 20,000. Resident bird species include wild turkeys, ruffed grouse, sharp-tailed grouse, woodpeckers, and nuthatches.

Mammals
The Refuge supports an assortment of mammals that contribute to the ecological, economic, and aesthetic value of central Wisconsin. Within the past three years, timber wolves have established two packs on Refuge land. Timber wolves are a top predator that play an important ecological role, as well as provide educational opportunities for Refuge visitors. Black bear and bobcat are also present in low numbers. White-tailed deer are very abundant and can be seen on the Refuge almost anywhere, and at anytime. Cottontail rabbits; snowshoe hare; gray, red, fox and flying squirrels; woodchucks; raccoon; skunks; red and gray fox; coyotes; muskrat; mink; otter; opossum; weasels; and badger are mid-sized mammals that serve as both predators and prey in Refuge plant and animal communities. Small mammalian residents include meadow voles, white-footed and deer mice, shrews, and moles. These small animals are a primary food source for many larger animals.

TABLE 1
Region 3 Fish and Wildlife Resource Conservation Priorities and Migratory Nongame Birds of Management Concern that occur on the Refuge and/or within the Yellow River Focus Area

Priority Species or Population Bird species in BOLD indicate Migratory Nongame Birds of Management Concern	Regional Status E = Endangered T = Threatened N = Nuisance TT = Tribal Trust R/E = Recreation/ Economic Value	Occurrence on Refuge A = Abundant C = Common U = Uncommon O = Occasional R = Rare				Current or Potential Habitat Supplied by the Refuge and/or the Yellow River Focus Area
		Spring	Summer	Fall	Winter	
Mammals						
Eastern timber wolf *Canis lupus*	Federally Endangered	O	O	O	O	Forests
Birds						
Double-crested cormorant *Phalacrocorax auritus*	Nuisance	R	R	R	R	Riverine wetlands, upland forests
American bittern *Botaurus lentiginosus*	Rare/declining	U	U	U		Palustrine wetlands, grasslands
Least bittern *Ixobrychus exilis*	Rare/declining	R	R	R		Palustrine Wetlands
Giant Canada goose *Branta canadensis*	Recreational and economic value	C	C	A		Lacustrine, Palustrine Wetlands
Trumpeter swan *Cygnus bicolor*	Rare/declining, Recreational and economic value	U	U	U		Lacustrine, Palustrine, Riverine Wetlands
Wood duck *Aix sponsa*	Recreational and economic value	C	U	C		Palustrine, riverine wetlands, mature bottomland forests
Mallard *Anas platyrhynchos*	Recreational and economic value	C	C	A	U	Palustrine wetlands, grasslands, mature bottomland forests
Blue-winged teal *Anas discors*	Recreational and economic value	C	C	C		Palustrine wetlands, grasslands
Canvasback *Aythya valisineria*	Recreational and economic value	U	C	U		Lacustrine, Palustrine, Riverine Wetlands
Bald eagle *Haliaetus leucocephalus*	Federally threatened, Tribal trust	U	U	U		Lacustrine, Palustrine Wetlands, Forests
Northern goshawk *Accipiter gentilia*	Rare/declining	O	O	O	O	Forests (mature upland)

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		Spring	Summer	Fall	Winter	
Red-shouldered hawk *Buteo lineatus*	Rare/declining	U	O	U		Forests (mature upland and bottomland)
American woodcock *Scolopax minor*	Rare/declining	C	C	C		Palustrine Wetlands (wet meadow and shrub/scrub), Forests (early successional)
Black tern *Chilodonias niger*	Rare/declining	U	U	R		Lacustrine, Palustrine Wetlands
Sedge wren *Cistothorus platensis*	Rare/declining	U	U	U		Palustrine Wetlands (wet meadows)
Cerulean warbler *Dendroica cerulea*	Rare/declining	R	R			Forests (mature upland and bottomland)
Grasshopper sparrow *Ammodramus savannarum*	Rare/declining	R	R			Open Landscapes
Henslow's sparrow *Ammodramus henslowii*	Rare/declining	R	R			Open Landscapes
Dickcissel *Spiza americana*	Rare/declining	R	R	R		Open Landscapes
Eastern meadowlark *Sturnella magna*	Rare/declining	U	U	U		Open Landscapes
Bobolink *Dolichonyz oryzivorus*	Rare/declining	U	U	U		Open Landscapes
Common Loon ***(Gavia immer)***	Rare/declining	U	O	O		Lacustrine Wetlands
Northern Harrier ***(Corcus cyaneus)***	Rare/declining	C	C	C	R	Open Landscapes
Upland Sandpiper ***(Bartramia longicauda)***	Rare/declining	O	O			Open Landscapes
Yellow-billed cuckoo ***(Coccyzus americanus)***	Rare/declining	O	O			Mature Forests (upland and bottomland)

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		Spring	Summer	Fall	Winter	
Short-eared owl ***(Asio fllammeus)***	Rare/declining	R		R	R	Open Landscapes
Red-headed woodpecker ***(Melanerpes erythrocephalus)***	Rare/declining	C	C	C	O	Forests (deciduous), Open Landscapes
Northern Flicker ***(Colaptes auratus)***	Rare/declining	A	C	A		Forests (deciduous), Open Landscapes
Olive-sided flycatcher (Contopus cooperi)	Rare/declining	R		R		Forests (early successional)
Verry ***(Catharus fuscens)***	Rare/declining	C	C	O		Forests (bottomland)
Blue-winged warbler ***(Vermivora pinus)***	Recreational and economic value	O	O	O		Forests (early successional), Open Landscapes
Chesnut-sided warbler ***(Helmitheros vermivorus)***	Rare/declining	U	U	U		Forests (deciduous)
Field sparrow ***(Spizella pusilla)***	Rare/declining	C	C	C		Open Landscapes
Insects						
Karner Blue Butterfly *Lycaeides melissa samuelis*	Federally endangered	O	C	O		Deciduous forests, savannas
Reptiles						
Eastern massasauga *Sisturus catenatus catenatus*	Rare/declining	R	R	R		Wet meadows, Forests (bottomland), Open Landscapes
Fish						
Bighead carp *Hypophthalmichthys nobilis*	Nuisance	C	C	C		Riverine (large rivers)

Reptiles and Amphibians

Reptiles and amphibians are important Refuge residents. Snake species include hog-nosed snakes, eastern garter snakes, smooth green snakes, northern water snakes, fox snakes, and eastern massasauga rattlesnakes. Five-lined skinks are a species of lizard that call the Refuge home. Painted, softshell, and snapping turtles can be seen in wetland environments; Blanding's turtles are most frequently seen in upland savanna environments. Frog and toad species that inhabit the Refuge include leopard frogs, green frogs, wood frogs, grey tree frogs, spring peepers, and the American toad. Blue-spotted salamanders are fairly common and can be found in dark moist environments, such as under decaying logs or thick leaf litter.

The eastern massasauga rattlesnake was once abundant throughout the central and northeastern United States. Many former populations are now gone, and the species is currently considered a candidate for Federal listing under the Endangered Species Act.

Invertebrates

Invertebrates are abundant on the Refuge and play an integral role in maintaining the ecological balance of several Refuge ecosystems. Wisconsin has approximately 20,000 species of insects - far more than any group of animals in the state. The Refuge is home to the world's largest remaining population of the Federally endangered Karner blue butterfly and also to the rare Leonard's skipper. Other rare insects that use the Refuge include the phlox moth, frosted elfin butterfly, Persius dusky wing, ringed bog haunter dragonfly, and two species of tiger beetles.

Fish

Fish species are also important members of the Refuge ecosystem. They cycle nutrients in aquatic systems and serve as food sources for a variety of birds and mammals. Although many fish species are at a disadvantage due to the drainage of Refuge pools for waterbird management, many people travel to the Refuge for rewarding year-round fishing opportunities on Refuge pools and ditches. Muskellunge; northern pike; large mouth bass; yellow perch; black crappie; pumpkinseed; black, brown, and yellow bullhead are some of the species most sought.

2.2 Listed Species

Federally listed threatened or endangered species that utilize the Refuge and the adjacent Yellow River area include the bald eagle, eastern timber wolf, and Karner blue butterfly. The eastern massasauga rattlesnake, which is currently a candidate for federal listing, is found in low numbers in the Yellow River area.

The attached Environmental Assessment (Appendix I) discusses these species in detail as well as Refuge management actions aimed at restoring and protecting their populations.

State-listed threatened or endangered species that use the Refuge include the bald eagle, red-shouldered hawk, Blanding's turtle, eastern massasauga rattlesnake, and trumpeter swan. The Refuge also supports several rare, threatened, or endangered species of plants. These include the prairie fameflower, small skullcap, oval-leaved milkweed, and wooly milkweed. Plant species that are necessary to support rare organisms include wild lupine and downy phlox.

There may be rare species of plants that have not been identified on the Refuge, particularly those that may be living in remote locations. While several studies have been done on plant abundance and distribution, a comprehensive inventory of Refuge plants is needed. The Refuge and the Yellow River area have populations of several rare and declining plant species (Table 2). Some of these include:

TABLE 2
Rare Plants found on the Refuge and within the Yellow River area

Common Name	Scientific Name	State Status*	Habitat/Location
Round-stemmed false foxglove	*Agalinus gattingeri*	State threatened (Federal status assessment in progress)	Southern Juneau County in dry prairies and bedrock glades
Wooly milkweed	*Asclepias languinosa*	State threatened	Dry savannas (oak barrens) in Juneau County, just south of Necedah Refuge
Brittle prickly pear	*Opuntia fragilis*	State threatened	Dry, sandy habitats in neighboring Adams County; may occur in similar habitats in Juneau County
Dwarf bilberry	*Vaccinium cespitosum*	State endangered	Sandy pine and oak savanna habitats, bracken grasslands
Sand violet	*Viola fimbrulata*	State endangered	Sandy pine and oak savanna habitats
Pale false foxglove	*Agalinus skinneriana*	State endangered	Dry savannas in Adams County
Tubercled or pale green orchid	*Plantanthera flava var. herbiola*	State threatened	Wet prairies and sedge meadows in Juneau and Adams counties
Umbrella sedge	*Fuirena pumila*	State endangered	Coastal plain species that inhabit peat and muck flats, wet sands, and fluctuating lakeshores
Bald rush	*Psilocarya scirpoides*	State threatened	Coastal plain species that inhabit peat and muck flats, wet sands, and fluctuating lakeshores

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Rare Plants found on the Refuge and within the Yellow River area

Common Name	Scientific Name	State Status*	Habitat/Location
Netted nut-rush	*Scleria reticularis*	State endangered	Coastal plain species requiring recently desiccated mud or sand lake beds with fluctuating water
Bog bluegrass	*Poa paludigena*	State threatened	Sedge meadows and tamarack bogs; has been documented in western Adams County.
Beak grass	*Diarrhena americana*	State endangered	Floodplain forest; may inhabit Yellow River bottoms, adjacent and east of Necedah Refuge

*There are no federally listed plants that are likely to occur on the Refuge.

2.3 Archaeological and Cultural Values

Archaeological records show evidence of human occupation in Juneau County since the end of the last Ice Age when Paleo Indians hunted large prehistoric animals. Every subsequent cultural period for the past 10,000 years is represented. The land now known as the Refuge was probably used by several cultures since the Ice Age. The peat-covered lowlands around the extensive marsh and shallow river environment contained a wide variety of food resources. Slightly higher ground would have been suitable for resource-extraction activities, but the people likely located their larger camps and villages on elevated land forms not found within the Refuge.

Archaeological investigations have covered 2 percent of the Refuge. The surveys and other sources have identified 27 prehistoric and historic sites (Figure 4). The earliest evidence of people on the Refuge has been dated to the Middle Archaic period of 5,000 to 3,000 years ago. The rest of the identified sites are camps from the Woodland period of 3,000 to 250 years ago, and farmsteads and cemeteries from the period of Western culture settlement and occupation. Prehistoric mounds, including effigy mounds, are reported near the Refuge. An inventory of Yellow River archaeological values and previous archaeological work within the Yellow River Focus Area has not been completed. As of November 1, 1998, the National Register of Historic Places contained seven properties in Juneau County and three properties in adjacent Jackson County. These properties include a bridge, houses, and prehistoric sites, including the Cranberry Creek Archaeological District three miles east of the Refuge.

Early 20th century fires burned across the Refuge area, destroying the peat so that now the sandy subsurface is exposed or shallowly covered with silt. The slight elevations that might have been used for resource extraction or temporary camps are virtually indistinguishable. In consultations with the Wisconsin State Historic Preservation Officer, the more efficient method of identifying archaeological sites would be to conduct a geomorphological investigation of the Refuge to determine where land forms exist that could have supported human use. The study conducted at Fort McCoy, Wisconsin, could be a useful prototype.

Indian tribes may have interest in the Refuge area in terms of traditional cultural properties and sacred sites, as well as claims to human remains, funerary objects, and other cultural items. During the early historic period in Wisconsin, Indian tribes were in a great state of flux, many tribes from the east having moved from their ancestral land and pushed the aborigines from Wisconsin to the south and west. Thus connecting historic period tribes with their prehistoric cultural antecedents in Wisconsin is problematic. People of the Late Woodland Lakes phases may have become the Menominee tribe. Evidence from archaeological excavations indicates that ancestors of the Winnebago had lived in eastern Wisconsin for hundreds of years; the Oneota of eastern Wisconsin may have been prehistoric Winnebago. In any event, historic records place Winnebago and Potawatomi in the area at the time of Western contact. The Refuge is within the area recognized by the Indian Claims Commission as being part of Menominee and Winnebago aboriginal territory. The Ioway spoke a Siouan language which likely links them to late prehistoric cultures of cental and southern Wisconsin. To a limited extent the Illinois were indigenous tribes in southern Wisconsin, probably not as far north as the Refuge. By the 1600s, however, a variety of tribal groups were moving in and out of areas south of the Refuge and may have spent limited periods of time in areas adjacent to and within the vicinity. These included the Sauk, Fox, Potawatomi, Kickapoo, Miami, and Mascouten.

2.4 Hydrology

Water plays an important part in the history of the Refuge. The sandy sediments and flat topography of the area are a result of Glacial Lake Wisconsin, a pre-historic lake that developed when a glacier blocked the Wisconsin River near Baraboo, Wisconsin. This extensive lake occupied large parts of Juneau and Adams counties, and parts of Wood, Portage, Waushara, Marquette, Columbia, Sauk, Richland, Vernon, Monroe and Jackson counties. Glacial Lake Wisconsin drained catastrophically about 13,000 years ago when the glaciers retreated.

Refuge Ecosystem

The Refuge is located in the Upper Mississippi River/Tallgrass Prairie Ecosystem (Ecosystem) which is one of eight hydrologically defined ecosystems that comprise the Great Lakes-Big Rivers Region of the Service (Figure 2). The Ecosystem is a large and ecologically diverse area that encompasses land in the states of Wisconsin, Illinois, Indiana, Iowa, Minnesota, and Missouri. The Mississippi River bisects the Ecosystem east and west. Other major rivers include the Minnesota, Chippewa, Black, Wisconsin, Iowa, Rock, Skunk, Des Moines, Illinois, and Kaskaskia.

Refuge Watershed

Located in the Castle Rock watershed, the Refuge is supported by an important hydrological system comprised of natural and manmade waterways in which materials and energy are transferred (Figures 5 and 6). Some, such as the Yellow River and its tributaries, provide an important ecological component to the Refuge by connecting biologically diverse food webs that provide important habitat features for wildlife. The Refuge, along with a series of other swampy basins such as Meadow Valley Flowage, Beaver Flowage, and numerous managed cranberry bogs, all contribute to the 7,800-square mile Middle Wisconsin River Basin. The Castle Rock watershed drains 3,259 square miles, contains 27 rivers and streams, and has 3,358 total river miles.

Water Sources and Sinks

On average, approximately 85 percent of the water entering the Refuge comes directly from precipitation, either as rain or snow (Table 3)(USGS Report). Precipitation averages about 32.6 inches annually. Streams that flow into the Refuge contribute about 13 percent of the water, while groundwater flow into the Refuge accounts for about 2 percent of the water, due largely to the interception of ground water by the extensive drainage networks surrounding the Refuge. Surface-water inflow to the Refuge includes: Remington Ditch (60%), Neal Lateral (15%), EBR-Spencer (11%), Meadow Valley (6%), and un-gauged (8%).

Of the water leaving the Refuge, about 62 percent is lost to evaporation from the pools or transpiration of water vapor back to the atmosphere from plants. Evaporation from open-water surfaces is estimated to be about 28 inches annually, as determined from a regional map of average annual lake evaporation (Kohler and others, 1959). Surface-water outflows from the Refuge, mostly through Rynearson Pools 1 (28%) and 2 (59%) and Suk-Cerney Pool (10%), constitute about 36 percent of the total outflows; groundwater flows out of the Refuge are about 2 percent of the total annual outflows. This small amount of groundwater outflow, along with larger surface water outflows, demonstrates the efficiency of the extensive drainage network within the Refuge boundaries. A natural topographic fall of 50 feet occurs from north to south across the Refuge, or roughly 2-3 feet per mile.

TABLE 3
Summary of Water Sources and Sinks for the Refuge
(May 1988 - April 1999)

Water Sources	**Annual Flow (acre-ft.)**
Precipitation	118,700
Surface Water Inflow	19,600
Ground Water Inflow	2,300
Total Water In	**140,600**
Water Sinks	**Annual Flow (acre-ft.)**
Evapotranspiration Loss	85,400
Surface Water Outflow	51,500
Ground Water Outflow	2,700
Total Water Out	**139,600**
Change in Storage (water inflow - water outflow)	1,000
Percent of Water Inflow	0.7

U.S. Geological Survey Fact Sheet, May 2000

From recent groundwater modeling of the Refuge, annual recharge was estimated to be 9.5 inches. Hence, evapotranspiration was 32.6 inches (precipitation) minus 9.5 inches (groundwater recharge), or 23.1 inches. This value agrees well with the findings of Weeks and Strangland (1971), who reported evapotranspiration values for nearby agricultural areas ranging from 15 to 20 inches per year, with higher rates expected in areas containing water-tolerant vegetation. Groundwater moves through the Refuge in a northwest to southeast direction traveling toward the Yellow and Wisconsin Rivers. Groundwater varies from 0 to 20 feet and is typically high in iron, with a pH of approximately 6.0, which is slightly acidic. Total dissolved solids and hardness are low. Groundwater recharge occurs primarily from percolation of precipitation through the loamy sands.

Water control structures within the Refuge regulate drainage. Water contained within certain Refuge pools provide and impact water manipulation capability on other pools. Water is generally stored in Refuge pools during spring runoff and is used to refill pools that are drained and re-flooded during the course of the summer.

2.5 Physiography

Bailey's Ecological Unit Classification System
As stated previously, the Refuge is located in the Upper Mississippi River/Tallgrass Prairie Ecosystem (Figure 2). Bailey's Ecological Unit Classification System (Keys et al., 1995) defines this ecosystem as laurentian mixed forest, eastern broadleaf forest, lower Mississippi riverine forest, and prairie parkland. The Refuge is located in the eastern broadleaf forest province within the central Wisconsin sand plain subsection (Figure 7).

Historic Condition
Historically, land in and around the Refuge was once a vast peat bog with some low wooded islands and savannas. The higher sand ridges were occupied by mature stands of pines and other species (Figure 8).

Current Condition
Today the Refuge consists of 43,696 acres of pine, oak, and aspen forests, grasslands and savannas, and wetlands and open water areas, all of which support a rich diversity of fish and wildlife (Figure 9). Table 4 is a summary of land cover types on the Refuge.

Large control structures manipulate the amounts of water leaving the Refuge. Changes in operation of the structure can drastically change water levels and complicate relations of water level stage and discharge.

TABLE 4 Land Cover Types on the Refuge	
Land Cover Type	**Acres**
Open Landscapes (grasslands, savanna, shrublands, old fields)	3,700 acres
Coniferous Forests	900 acres
Mixed Deciduous and Coniferous Forests	10,000 acres
Broad-leaf Deciduous Forests	5,600 acres
Emergent Wetlands and Wet Meadows	10,500 acres
Forested Wetlands	5,700 acres
Lowland Shrubs	5,500 acres
Open Water Areas	1,800 acres

Data Source - WISCLAND (1994)

Refuge forest communities (upland) include northern mesic forest (white and red pine, bigtooth aspen, trembling aspen, red maple) and mixed wet-mesic forest (jack pine, northern pin oak, red maple, trembling aspen, paper birch). Refuge forests provide excellent habitat for many neo-tropical migratory birds such as the scarlet tanager, eastern wood-pewee, and ovenbird. Currently upland forests on the Refuge comprise roughly 16,500 acres.

Refuge grasslands, savannas, fallow fields, and shrublands comprise open landscapes on the Refuge. Refuge grasslands include prairies, fallow fields, and meadows. Tree cover on the grasslands ranges from little to none. Plant cover is a mixture of sedges, grasses, and forbs that attract nesting bobolinks, vesper sparrows, grasshopper sparrows, and upland sandpipers. Some common grassland species on the Refuge include big bluestem, little bluestem, Kentucky bluegrass, and a wide variety of other grasses, sedges and forbs. Blackberry and spirea are scattered in grassland areas as well. Willow-dogwood communities are invading old farm fields and wet meadows in places where disturbance is rare. Refuge grasslands provide important nesting habitat for many migratory birds including ducks, geese, and Sandhill cranes, and also serve as grazing sites for white-tailed deer.

Refuge savannas include northern pin oak, jack pine, warm season grasses, upland sedges, blueberry, goldenrod, and wild lupine. These savanna areas are also known as barrens, because fire and tree diseases such as oak wilt are more common in the droughty, sandy soils. These disturbances keep the trees small and scattered. Oak savanna has been defined as having at least one tree per acre, but less than 50 percent cover. Wisconsin historically had over 4 million acres of barren habitat covering 12 percent of the state. Today less than .14 percent remains. Refuge savannas support massasauga rattlesnakes, phlox moths, Blandings turtles, Karner blue butterflies, and over 110 species of birds. Currently, open landscape lands on the Refuge comprise roughly 3,700 acres.

Savanna or "oak barren" restoration on the Refuge after timber harvest and two burns. The land will continue to adjust to this new condition for several years before it will be considered completely "restored." Historically there were 4 million acres of oak barrens in Wisconsin. Today, less than 5 thousand acres remain of high quality barrens.

Refuge wetlands include forested, non-forested, and open water wetlands. The majority of these occur within pools, streams, and ditches. Wetland plant species include pondweeds, spike rushes, elodea, coontail, milfoils, and duckweeds. Some Refuge pools are drawn down for part of the year to promote the production of high energy waterfowl foods such as millet, smartweed, chufa, beggar ticks, pigweed, sedges, and spikerush. Ditches and streams also provide additional wetland habitat, although to a lesser extent than Refuge pools.

Wet meadows and marsh edges consist of bur-reed, smartweeds, beggar's ticks, bulrushes, blue-joint grass, and reed canary grass. Open sedge meadows comprise mixed sedges with invading jack pine, willow, and hardhack. Sedge meadows on the Refuge are home to northern harriers, sedge wrens, and sora rails.

Bottomland forested areas include jack pine, silver and red maple, green ash, northern pin and swamp white oak, river birch, and trembling aspen. Tamarack was historically present in these areas. Currently non-forested, forested, and open water wetlands comprise 23,500 acres.

2.6 Geology

The Refuge is located in the central plain province of Wisconsin within an area known as the Great Central Wisconsin Swamp, an extensive alluvial lake plain which extends over 2,000 square miles. The Refuge is underlain by a Precambrian Crystalline bedrock complex which surface varies in elevation from approximately 860 Mean Sea Level at the north end of the Refuge to

approximately 760 M.S.L. at the south end. The Precambrian bedrock is overlain by an estimated 30 to 100 feet stratum of late Cambrian sandstone.

Refuge Soils
Soils on and around the Refuge represent three major soil associations consistent with central Wisconsin landscapes: Aus Gres loamy sands and Morocco silt loams, Plainfield and Nekoosa loamy sands, and muck and peat soils (Figure 10). The dominant soil association is the Plainfield and Nekoosa loamy sands. Newson and Dawson peat soils are found in the impoundments, along drainage ditches, and in marshes. These soils are usually inundated and consist of partially decayed organic matter and mineral soils.

2.7 Social and Economic Resources

In 1998, the Refuge completed an economic assessment to estimate the regional economic and national social welfare impacts of the Refuge (Appendix IV). **However, some of the data used to generate the economic report is associated with significant uncertainty. As a result, the estimates in the report should be interpreted with uncertainty in mind.** A brief summary of that report follows.

Within the 4-county region surrounding the Refuge (Wood, Juneau, Adams, and Monroe counties), agricultural activities constitute an important component of the economy. This sector includes both dairy farms and farms that grow row crops (e.g., sweet corn, potatoes, snap peas). Cranberry production is also important, and is considered a premium crop in that it commands a high price in the market. Cranberry beds, while representing a small percentage of the total land area, are scattered throughout the region. The total acreage of cranberry beds currently in Juneau and Wood counties alone is estimated to be 4,500. Because the region has large tracts of both private and public forest land, the timber industry is important to the economy as well. Wood County is the most populous and the strongest economically of the four.

These four counties offer a variety of recreational activities on both public and private land. Along with the Refuge, there are several other public recreation areas. These include Sandhill Wildlife Area, Wood County Wildlife Area, and Meadow Valley Wildlife Area. Other recreational and camping areas nearby include Buckhorn State Park and Wisconsin Dells, which are south of the Refuge. These offer substitute sites and opportunities to the Refuge for hunting, fishing, wildlife viewing, photography, and other recreational activities.

Commercial activities on the Refuge include timber harvesting and trapping for pelts. Several of the surrounding towns maintain roadways that pass through the Refuge. Funding for road maintenance on Federal property helps supplement the tax base used to fund road projects. The Refuge annual budget ($750,000 in 1998) supports employee salaries, operation and maintenance, education, and improvement projects such as bridges, dams, and roads.

Some popular commercial and Refuge management economic activities on the Refuge are:

- The annual budget for staff salaries, maintenance, operations, small capital purchases and educational programs was $750,000 in 1998.
- Each year, sections of the Refuge are selected for timber harvesting to maintain quality habitat for plants and animals. In 1996-97, 3,237 cords of wood were harvested worth $155,758.
- Trapping is an important management tool used to reduce or prevent damage to Refuge roads, dikes, and water control structures. Trapping may also reduce predation on nesting birds. Trapped species include mink, beaver, muskrat, and raccoon. The annual average value of pelts taken between 1980 and1995 was $6,858.
- In addition to maintenance of land by the Refuge, certain roads within the boundary of the Refuge are maintained by the surrounding townships of Necedah, Finley, Cutler, Remington, and Kingston. These townships spend, on average, approximately $96,000 annually (1996 dollars) for road maintenance, with a large part of this cost for snow removal.

Conclusions drawn from Refuge-dependent commercial and Refuge management economic activities include:

- Refuge spending contributes over $1 million and roughly 18 jobs to the regional economy.
- Refuge road maintenance and timber harvesting produce similar effects on the regional economy, accounting for approximately $150,000 each year.
- Furbearer trapping plays a minor role in the overall regional economy, accounting for only $7,000 of regional output and less than one job.

The Refuge also has an indirect economic impact on the local economy through the many recreational activities it supports. Among these are hunting, fishing, wildlife viewing, berry picking, cross-country skiing, and photography. Although the Refuge charges no entrance fee, individuals that visit the Refuge and participate in these activities purchase a variety of goods and services in the towns surrounding the Refuge (e.g., food, lodging, fuel, equipment), and thus contribute to the regional economy.

Some of the more popular recreational activities on the Refuge are:

- Hunting for both large (white-tailed deer) and small game species (grey, red, and fox squirrel; rabbit; snowshoe hare; ruffed grouse; waterfowl; wild turkey; and raccoon). In 1996, an estimated 10,000 trips were made to the Refuge for the purpose of hunting.
- Fishing on Refuge waters, primarily for northern pike, bullheads, crappie, yellow perch, and sunfish. In 1996, approximately 7,000 trips were made to the Refuge for the purpose of fishing.
- Wildlife viewing accounted for over 106,000 trips to the Refuge in 1996.
- Blueberry, raspberry, and blackberry picking are popular during the summer season.

Conclusions drawn from Refuge-dependent recreational activities include:

- Wildlife viewing has the greatest effect on the regional economy, accounting for between $1.9 million and $2.3 million of regional output and between 48 and 67 jobs.
- Recreational hunting has the second greatest effect on the regional economy, accounting for $250,000 and 6.8 jobs.
- Fishing produces the third greatest regional economic effects, accounting for $220,000 of regional output and 5.9 jobs.

3. REFUGE OPERATIONAL COMPONENTS

3.1 Fish And Wildlife Management

Birds

Most bird management on the Refuge is accomplished through habitat management. The Refuge's prescribed burning and savanna restoration programs are designed to directly benefit nesting grassland birds in open and semi-open landscapes. These programs were initially created to increase the amount of suitable waterfowl nesting habitat. The Refuge also attempts to attract waterfowl, shorebirds, and other marsh birds by managing water levels on most of its main pools. The purpose of water level manipulation on these pools is to grow food plants and to increase the availability of aquatic invertebrates that are favored by migrating water birds. In the mid-1960s to early 1970s, the Refuge created woodcock habitat with its forestry program. This was accomplished by clear-cutting small linear strips of forest in successive years, which created young stands of aspen. Now, Meadow Valley Wildlife Management Area, immediately adjacent to the Refuge (see Figure 3), maintains extensive areas of young forest, which is prime woodcock habitat and habitat for many warblers. Wetland restoration and prescribed burning activities have been used to restore and maintain sedge meadows on the Refuge. This provides nesting habitat for birds including sedge wrens, sparrows, rails, and warblers.


Black tern

There are several migratory bird conservation initiatives that the Refuge participates in to the extent applicable and practical. The North American Waterfowl Management Plan (NAWMP) is a partnership effort to restore waterfowl populations to historic levels, with objectives and strategies evolving through NAWMP Updates (the latest produced in 1998). The Refuge is found within the Upper Mississippi River and Great Lakes Joint Venture area of the NAWMP and contributes to the achievement of waterfowl objectives outlined in the Implementation Plan for this area.

Several non-game bird initiatives are in the planning stage, with implementation beginning in the near future. Partners In Flight (PIF) is developing Bird Conservation Plans, primarily for landbirds, in numerous physiographic areas; these plans include priority species lists, associated habitats, and management strategies. The same elements will be byproducts of ongoing planning efforts for shorebirds (U.S. Shorebird Conservation Plan) and colonial waterbirds (North American Colonial Waterbird Conservation Plan). The Refuge will strive to implement

conservation strategies outlined in these plans as they are developed. The Refuge lies within PIF Physiographic Area 16 (Upper Great Lakes Plain) and 20 (Boreal Hardwood Transition).

The U.S. Shorebird Conservation Plan and the North American Colonial Waterbird Conservation Plan have identified priority species and conservation strategies, mostly focused around habitat, that will address the needs of those groups of birds. At some future point it is hoped that all migratory bird conservation programs will be integrated under the umbrella of the North American Bird Conservation Initiative. This is a continental effort to have all migratory bird initiatives operate under common Bird Conservation Regions and for implementers to consider the conservation objectives of all birds together to optimize the effectiveness of management strategies.

Nest Structures

In the past, the Refuge had an extensive wood duck and bluebird nest box program that ran from the 1970s into the 1990s. During this time, approximately 200 nest boxes for both wood ducks and bluebirds were placed on the Refuge. Success of the nest box program was monitored by Refuge volunteers. Wood duck boxes have not amply contributed to wood duck production on the Refuge as most nesting occurs in abundant natural cavities. Therefore, it is anticipated that the wood duck nest box program will be phased out over the next 10-15 years and the bluebird program maintained by outside interests.

Trumpeter Swans, eliminated from Wisconsin by over hunting, were reintroduced at several sites in the state, including the Refuge.

The Refuge has one known active bald eagle nest that is protected during the nesting season by minimizing all human activity around it. This includes activity by the public, Refuge staff, and aircraft activity associated with the Hardwood Bombing Range located nearby.

Reintroductions

Reintroduction activities for three bird species have been conducted on the Refuge. Wild turkeys that were trapped in Pennsylvania were released on the Refuge in the mid-1960s. Sandhill cranes were hatched in captivity and released on the Refuge in the early 1980s. A similar project was conducted for trumpeter swans in the early 1990s. Eggs were collected in Alaska, the young were hatched in captivity and released at three different locations on the Refuge.

In 1999 the Refuge was selected as a reintroduction site for the endangered whooping crane. Whooping crane chicks were introduced at the Refuge in the summer of 2001as part of a

whooping crane reintroduction project to establish a migratory population in the eastern U.S. to contribute toward recovery of the species. The population has been designated as a non-essential population (NEP) in a rule making action finalized on June 26, 2001. The crane chicks are being reared in a pen situation and trained to follow ultra light aircraft in migration to a selected wintering site at Chassahowitzka National Wildlife Refuge. Annual whooping crane introduction, rearing, and release activities are expected to continue for a period of 10 years.

Mammals

There is little active management for mammals on the Refuge. Public hunting and trapping are two management tools used to control certain mammalian populations. Small game hunters pursue gray and fox squirrels, cottontail rabbits, snowshoe hares, and raccoons. All other mammalian species that are otherwise legal small game are protected on the Refuge. Coyotes and red and gray foxes benefit from this policy more than any other mammalian species. White-tailed deer and black bear are the only big game mammals found on the Refuge, and only the white-tailed deer can be hunted within Refuge boundaries. Harvest levels on the Refuge are set by the Wisconsin Department of Natural Resources. The Refuge is currently part of deer management units 53 and 56.

Trapping by permit is allowed on the Refuge to aid in management of several mammal populations. Each fall, six trapping permits are awarded by drawing, and successful trappers then have exclusive rights to the area for which their permit is issued for. Trappers are not allowed to make dry-land sets and can only trap raccoon, beaver, muskrat, mink, skunk, and opossum. This policy has the greatest protective effect on otter, coyotes, and grey and red foxes.

Reptiles and Amphibians

Restoration of thousands of acres of wetlands on the Refuge has re-created reptile and amphibian habitat that had been lost due to drainage and farming. Savanna restoration efforts on the Refuge also benefit the Blanding's turtle, which lays its eggs in these areas. Regulations prohibiting the collection of reptiles and amphibians are enforced on the Refuge.

Invertebrates

The only direct management the Refuge does for invertebrate populations is for the federally endangered Karner blue butterfly and gypsy moth. The Refuge monitors Karner populations and the populations of associated plant species, such as wild lupine, the Karner's sole larval food source. The Refuge modifies its prescribed burns and mowing plans so as not to disturb Karner habitat.

The Refuge also cooperates with the Department of Agriculture Trade and Consumer Protection, the Wisconsin Department of Natural Resources, and the USDA Animal and Plant Health Inspection Service in their efforts to survey gypsy moth distribution, abundance, and spread.

Fish

Management of Refuge fish populations is currently limited due to shallow water and periodic draw-downs in most impoundments. Some Refuge impoundments are

periodically sampled to determine which fish species are present. In the past, rough fish have been killed by lowering pool levels in the winter, which freezes the fish out. This is no longer practiced. During summer draw-downs, stranded native fish and/or fish that are passing through the dam have been transferred to other pools. Two aspects of wetland management are problematic with respect to managing the Refuge for maximum fisheries benefits. First, managing high quality, open wetland systems is difficult because technology is currently limited to effectively control nuisance carp and encourage desirable fish utilization. Secondly, many controlled high quality wetlands are regulated following water management regimes that tend to limit fish use and production.

3.2 Habitat Restoration

Habitat restoration at the Refuge involves using a variety of tools and techniques to enhance the composition, structure, and function of wetland and upland communities for threatened and endangered species, waterfowl and other migratory birds, and native flora and fauna.

Wetland Restoration
The Refuge is located in an area historically known as the Great Central Wisconsin Swamp, a vast lowland area spanning hundreds of square miles. During European settlement, the majority of wetlands in the area were drained, logged, and farmed. Over the years, Refuge staff have restored many of these former wetlands for a variety of reasons, including to provide habitat for wildlife, to aid in flood control, and to provide recreational opportunities for the public. The two most common ways wetlands are restored on the Refuge are plugging drainage ditches and constructing new dikes with water control structures. If management objectives for an area require an open vista, timber harvest may be used to speed up the process (trees would eventually be eliminated by higher water levels anyway). Native wetland plants soon return to these restored areas, as seeds lie dormant in the soils. Woody vegetation is managed to maintain open or semi-open wetland habitats by regulating water levels in Refuge pools. Some restored wetlands are also burned or mowed to maintain the desired vegetation composition.

Upland Restoration
Restoration of upland habitats on the Refuge includes establishing and maintaining productive grasslands and savannas for migratory birds, threatened and endangered species, and other wildlife and plants. Timber harvest is a tool used extensively on the Refuge to restore and maintain upland areas such as semi-open savanna habitats. Timber harvest is also used to eliminate hazardous standing dead trees and reduce fuel loading, especially along the southern edge of the Refuge near the town of Necedah. Mowing is often used to maintain open areas, dikes, fire breaks, and safe roadside visibility conditions. Prescribed burning is used to restore and maintain semi-open and open habitats such as savannas, grasslands, and sedge meadows.

3.3 Habitat Management

Water Level Management
In most cases, management of wetland habitats at the Refuge involves the manipulation of water to achieve the desired successional stage of wetland plant communities. Hydrologic cycle maintenance plays an important role in the life cycle of wetlands. As wetland soils go through the drying process, nutrients are released and made available for plant growth. Upon re-flooding, the

wetland is rejuvenated and results in an area thriving with insect life and aquatic vegetation. Forested wetlands are managed primarily by limiting human influence to maintain natural levels of hydrologic change. Sedge meadows are managed in this way and are also burned with prescribed fires to help maintain their open character. The Refuge has a Marsh and Water Management Plan, date June 1992, that provides guidance on day-to-day water management.

Moist Soil Management

Management of Refuge wetlands for moist soil plant production is a major part of wetland management activities on the Refuge. Moist soil habitats provide shallowly flooded food resources (seeds, invertebrates) for migrating dabbling ducks, shorebirds, other marsh birds, and Canada geese. The greatest use by all waterbirds occurs in the fall, but moist soil units provide a variety of resources for waterbirds and other wildlife species throughout the year. Moist soil units usually remain flooded for two years and are drawn down during the spring of the third year to make conditions suitable for germination of native moist soil plant species such as smartweed, millet, beggars tick, rice cutgrass and chufa. Drained pools are partially re-flooded in September to a depth of about 18 inches to provide optimum foraging conditions for dabbling ducks. Mud flats and shallow pool edges enhance food availability for shorebirds and other marsh birds. From that point, flooding continues at 6-inch increments making additional food available as the earlier flooded food is consumed. By the end of migration, water levels are brought up to full pool elevation. Some Refuge pools are drained in early August for green browse production, which is used primarily by Canada geese and sandhill cranes. Other pools are partially drained in October to concentrate and expose invertebrates, insect larvae, and minnows as an additional food source for shorebirds, ducks, and geese.

Grazing, Haying, and Mowing

In the past, grazing was used on the Refuge as habitat management tools. During the mid-1970s, a cooperative grazing program was initiated to control woody vegetation on the Pharm-Becker field. However, maintaining suitable fences proved costly and grazing as a management tool was discontinued soon after.

Cooperative haying was also used as a management tool to maintain habitat for nesting birds and to provide green browse for Canada geese during fall migration. Harvesting typically began after July 15th and was completed by September 1st. Application of lime and fertilizer was required to maintain legume crops due to the Refuge's sandy soil. Because of this, the activity proved cost prohibitive and was later discontinued. Currently there is no interest in haying Refuge land.

Mowing is regularly used as a habitat management tool on the Refuge. Each year Refuge staff mow about 300 acres to maintain the smaller open areas on the Refuge. Dikes, roadsides, and firebreaks are also mowed. A hydro-axe is used in areas containing large woody vegetation.

Farming

In the past the Refuge actively farmed 150 acres of Refuge land to supply migratory waterfowl and white-tailed deer with food. Clover, rye, millet, and buckwheat were the primary crops. Farming as a program was phased out on the Refuge beginning in the early 1990s in favor of more ecologically sound ways of providing food for wildlife. In place of row crops, the Refuge now focuses on increasing the availability of native food plants, such as oak shrubs for woody browse, releasing competition between mature oaks to increase mast production, native forbs as

green browse, and moist soil management, which produces native seed crops for migratory birds. Certain farming practices may be used occasionally on the Refuge as a tool to achieve some of the above-mentioned natural foods.

Forest Management

Management of Refuge forests are guided by the Refuge's 1994 Forest Management step-down plan. The primary objectives for forest management are to provide and restore endangered species habitat, reduce wildfire hazard, and manage existing pine plantations to phase out monoculture management. This is accomplished through savanna and sedge meadow restoration and reducing the density of jack pine on the Refuge's eastern border, as well as other areas, to reduce the risk of wildfires spreading beyond the Refuge boundary. Commercial timber sales and firewood cutting are used to accomplish management objectives.

Timber sales accomplish Refuge ecological objectives and contribute to the local economy. Refuge staff mark boundaries and trees to ensure sales meet ecological objectives. Staff also determine timber volumes for each stand. Timber is cut and removed from the Refuge by private wood contractors. Contracts for all sales are selected by sealed bid.

Archaeological surveys are required if any part of the timber harvest operation will disrupt the soil to a depth of 6 inches or more. If haul roads and/or yarding areas are to be constructed, an archaeological survey will be required in those areas. The surveys are funded and arranged by the wood contractor. The cost of these surveys is reflected in the bid price for the timber. When no other source of funding is available and the cut is necessary to meet ecological objectives, the Refuge supports the cost of the surveys. The establishment of firebreaks is also written into timber contracts when prescribed fire is a part of planned management. Refuge roads used for haul routes are required to be rehabilitated by grading and 4 inches of gravel, at the completion of the logging operation. The contractor is responsible for this cost which is reflected in the bid.

In recent years, the Refuge has conducted approximately two to four timber sales per year. Sales usually are between 40 and 400 acres. Jack pine, red pine, aspen, and Northern pin oak (Hill's oak) are the species with the greatest quantities harvested. Contractors are generally allowed one to two years to complete each sale. Most harvesting is done during the winter months when the ground is frozen to prevent damage to soil, vegetation, and archaeological resources. No harvesting is done in areas where pin oak is present during the months of April through July when trees may be infected with the oak wilt fungus.

Refuge timber resources are also available to the general public in many locations by Special Use Permit. Permits to harvest dead and down wood cost $5.00 for a six-month period. Firewood cutting removes dead wood left over from timber harvest operations, thus reducing wildfire danger, and provides an inexpensive source of firewood for people in the surrounding communities who do not own firewood-producing lands of their own.

Timber stand improvement (TSI) is a forest management practice used at the Refuge aimed at improving the health and vitality of a timber stand and generating more income at a faster rate from the wood produced. The major benefit from TSI at the Refuge will be realized in pine plantations. Over a period of the first 20 years of a pine plantations life some of the trees will become overgrown by others. These smaller trees can be harvested in a thinning cut to allow the

other trees adjacent to them to grow more vigorously. These remaining trees may be pruned of lower limbs to a height of about 20 feet to promote a larger and clearer bowl that is free of knots. The improved quality of the lower two logs of the tree are of greater value to the logging contractor and produce a healthier tree. Other TSI practices remove any remnant or invading vegetation such as oak sprouts, aspen and other hardwood species that also compete for nutrients.

The Refuge has not implemented TSI activities on existing pine plantations except for occasional thinning cuts. Although the Refuge's desired future condition (Figure 13) favors eliminating most monoculture pine plantations, the Refuge plans to use TSI practices in these plantations until such time that the plantation is completely harvested.

Although TSI in other mixed pine/hardwood forest stands is possible, it is impractical from an economical standpoint because of the vast area of these types of stand on Refuge lands and the minimal affect TSI would have. More importantly, TSI is not in keeping with the Refuge's primary mission, the conservation and management of fish, wildlife, and plants.

Fire Management

Over many centuries, wildland fire has influenced the life cycles of plants and plant communities. History shows that wildland fires were once common in a variety of ecosystems, including those found on the Refuge. Many ecosystems adapted to fire, and some are even dependent on fire for critical functions such as seed germination and growth, return of nutrients in dead foliage to the soil, control of competing plants and plant communities, and prevention of stagnation in the last stage of the fire cycle. Fire is the key that starts the cycle again. It gives many plants and animals a chance to reproduce and grow again. The renewed supply of nutrients and light produces forage and cover used by wildlife. Under appropriate circumstances, prescribed fire can be reintroduced into many ecosystems. Such application of fire to natural or modified wildland fuels is done under specific, preplanned conditions. The fire is confined to a specific area, is planned to produce the intensity required to attain desired objectives, and is carried out by trained burn managers.

The Refuge is located in an area that is at a high risk for wildfires. This is caused by the dry sandy soil which promotes the growth of jack pine and light fluffy grasses and shrubs that carry fire well. Jack pine is especially adaptable to fire. Although all other species of trees and vegetation will burn, the jack pine-oak ecosystem, which is characteristic of central Wisconsin, is one of the most fire-prone areas of the country. Forest management practices are used on the Refuge with wildfire prevention in mind.

Since 1948, 63 wildfires have occurred on the Refuge. Eliminating the occasional large and small fires, the average size appears to be about 10 acres. The cost to Federal and state forces responsible for their suppression is about $7,000 each. Highest fire danger periods occur in the spring and fall when temperatures are mild, humidity low, and fuels dry. Regular precipitation during the summer months and green vegetation usually lead to moderate to low fire danger. Snowfall during the winter usually eliminates any fire danger during that period.

Refuge staff annually burn an average of 2,000 acres of Refuge land to enhance habitat for upland game, waterfowl, and endangered species. The periodic burning of savannas, grasslands,

and sedge meadows reduces encroaching vegetation such as oak sprouts and willow. It also encourages the growth of more desirable species like blueberry, raspberry, and wild lupine (a plant necessary for the survival of the endangered Karner blue butterfly).

All prescribed burns are carried out by highly trained and qualified personnel who perform the operation under very precise plans. No burning takes place unless it meets the qualifications of the prescription for each unit. A prescription is a set of parameters that define the air temperature, fuel moisture, wind direction and velocity, soil moisture, relative humidity, and several other environmental factors under which a prescribed burn may be ignited. This insures that there is minimal chance the fire will escape the unit boundaries and that the fire will have the desired effect on the plant community.

Pest Management

Invasive weeds are the primary pest species of concern at the Refuge. Spotted knapweed, leafy spurge, and purple loosestrife are of greatest concern. Spotted knapweed occurs mostly on roadsides near the Refuge's boundary, and to date has not invaded higher quality interior habitats. No control takes place at this time. Leafy spurge occurs in one isolated pocket near the road entrance to Suk Cerney Pool. The Wisconsin Conservation Corps crew assigned to the Refuge has been clipping the plants before they flower. Purple loosestrife occurs in areas around the Refuge, but has not yet been found on the Refuge. Refuge staff regularly monitor wetland areas for signs of loosestrife invasion.

The Refuge has two notable forest pests, oak wilt and the IPS beetle. Oak wilt, caused by the fungus *Ceratocystis fagacearum*, is a primary cause of red oak mortality on the Refuge and in south central Wisconsin. A study by the U.S. Forest Service in 1979 concluded that oak wilt accounts for less than 1 percent of volume loss of red oaks on the Refuge. Research on oak wilt ecology was conducted on the Refuge in the mid 1990s; this research showed that oak wilt was a natural disturbance process that actually helps maintain savanna habitats on the Refuge. Therefore, the Refuge does not implement oak wilt control methods. The IPS beetle is another pest that occasionally infests red pine. Infestation sites are usually less than two acres in size. Since wood production is not a purpose of the Refuge, IPS beetle control is a low priority.

Carp are another notable pest species found on the Refuge. Carp retard the growth of aquatic vegetation by consuming it and by roiling the water causing turbidity, which reduces photosynthetic efficiency, an essential component of wetland food chains. Several pools are drawn down as a part of the Refuge's moist soil management program, which keeps carp populations in check. No other active management occurs for this species.

On occasion, beaver dams obstruct water flow along Refuge drainage ditches, sometimes threatening to flood Refuge or township roads. Beaver are trapped as a part of the Refuge's public use program and Refuge staff eliminate beaver dams as problems arise.

3.4 Resource Protection

The Refuge protects its fish, wildlife, plant, archaeological, and cultural resources through enforcing laws and regulations, pursuing the protection and acquisition of additional land,

investigating and cleaning up contaminants, and ensuring adequate receiving waters through the enforcement of water rights.

Law Enforcement
The purpose of the Refuge's law enforcement program is to offer protection for Refuge resources and the public through the efforts of highly trained professional officers. The Refuge currently employs two staff members whose law enforcement duties are concurrent with their other primary duties.

The authorities for law enforcement on refuges originate from several Federal statutes, but primarily are derived in the Archaeological Resources Protection Act of 1979; the Lacey Act (1981 Amendments); the Endangered Species Act; the Migratory Bird Treaty Act; the Migratory Bird Hunting and Conservation Stamp Act; and the National Wildlife Refuge Administration Act. Federal regulations specific to Refuges are derived from the National Wildlife Refuge Administration Act, including Refuge authority for enforcing state laws governing hunting, fishing, and motor vehicle use. Some common law enforcement activities on national wildlife refuges include:

- Assisting visitors in understanding Refuge laws and regulations.
- Protecting Refuge property and its fish, wildlife, plant, cultural, and archaeological resources from illegal activities by visitors or trespassers.
- Protecting Refuge visitors and their possessions from disturbance and harm by other visitors or themselves.
- Ensuring compliance with Refuge and state regulations governing the use and enjoyment of the Refuge.

Permits and Economic Use Management
All uses and activities of the Refuge that are not available to the general public are controlled through a permitting system. Contract labor and construction is regulated through work orders, purchase orders and contractual agreements. Other uses are controlled through the issuing of Special Use Permits. These permits regulate firewood cutting, biological research and specimen collecting, commercial photography, special access for individuals with disabilities, trapping, and commercial timber harvest. Allowed activities and special conditions are detailed on the Permit. Commercial timber harvest and trapping bring the most significant economic returns to local communities.

Within the Refuge Management District (See Figure 12), Special Use Permits have been used to allow limited grazing, haying, firewood harvesting for personal use, and fence construction that are deemed compatible with the purposes of Conservation Easements developed as part of the Service's Private Lands program.

Contaminant Investigations and Cleanup
The Service has adopted a Contaminant Assessment Process (CAP) to provide a systematic, cost-effective approach for evaluating whether environmental contaminants pose threats to all National Wildlife Refuge System lands. Recently, contaminant-related information was gathered for the Refuge and a data base was established to assist in land management decisions. The database contains physical and biological descriptions of the Refuge as well as potential

contamination sites off the Refuge. Application of the process will also identify areas vulnerable to spills or releases of oil or hazardous substances which will lead to baseline data collections. The CAP for the Refuge is complete.

The Service completed one contaminant cleanup in April 1995, in which three barrels with unlabeled contents were removed from a former Civilian Conservation Corps work site and properly processed. Any contaminated soils were also removed from the site and incinerated. As a precautionary measure, all unused Refuge underground fuel storage tanks were removed in 1986, and remaining tanks in use were taken out of service and removed in 1993. No soil contamination was detected at these sites.

Before the Service acquires an interest in any property, either fee purchase or easement, an Environmental Site Assessment is completed. This assessment is used to ascertain the likelihood, and extent, of hazardous substances or other environmental problems associated with a property, and any needed remediation or cleanup costs.

This analysis was performed on the last Refuge tract purchased in 1994, and on all conservation easements within the Refuge Management District. There are currently two Refuge staff trained to perform these investigations.

Water Rights Management

The Refuge contains approximately 23,500 acres of wetlands. Much of this wetland is impoundments, created to approximate wetland values that existed prior to agricultural drainage in the early 1900s. About 70 percent of the Refuge water supply enters the Refuge from the north, through the Remington diversion structure in the northwest and the Spencer-Robinson ditch in the northeast.

The Remington diversion structure was built around 1940 to allow additional inflows to the Yellow River to run a small hydroelectric generator. The structure was designed with a maximum stop-log elevation of 958.0 M.S.L. The Refuge has a long history dating back to at least the mid-1970s of setting these stop-logs to 957.5 and diverting all water that passed between the 957.5 and 958.0 elevations. Water below the 957.5 or above the 958 level is diverted to the Yellow River, even though the power generating facility no longer exists. This setup prevents flood waters from damaging Refuge or township culverts and water control structures. During the late 1980s, cranberry operations were developed both along the Remington diversion ditch and the Spencer-Robinson ditch north of Refuge property. This placed demands on traditional Refuge water uses. The Refuge has obtained a Field Solicitor's opinion (from the Service's legal branch) regarding the established use along the Remington diversion structure which affirmed the Service's right to continue this established use even though state law gives agricultural users and cranberry farms a priority use.

The primary conflict in water use comes in August, September, and early October, when the Refuge re-floods moist soil impoundments for migrating waterfowl use. This is also the time that cranberry growers typically flood their beds for harvest. The Refuge has had requests from growers to change its water discharge to accommodate agricultural needs. Therefore, it is critical that the Service document existing water rights to provide a solid informational and legal basis for making future management decisions regarding source waters.

Cultural Resource Management
Archaeological investigations and collecting are performed only in the public interest by qualified archeologists working under an Archaeological Resources Protection Act permit issued by the Regional Director. Refuge personnel take steps to prevent unauthorized collecting by the public, contractors, and Refuge personnel. Violations are reported to the Regional Historic Preservation Officer.

The Refuge has museum collections (art, documents, botany, zoology) that are managed under a Scope of Collection Statement (10-31-94). To date, three archaeological investigations have produced 40 artifacts from Refuge lands; artifacts are or will be stored at the Mississippi Valley Archaeology Center under a cooperative agreement.

Special Designations
There are four established natural areas on the Refuge. The 100-acre Necedah Jackpine-Oak (Research Natural Area) is located in Section 34 of the southeast quarter of the Refuge, north of Becker Road. It is designated a SAF-14, Northern Oak-Pine type ecosystem. This area is managed as an oak-jack pine forest. No logging or prescribed burning is permitted, and the area is protected from wildfire to the extent practical. The Wisconsin Scientific Areas Preservation Council refers to this area as the Necedah Oak-Pine Natural Area (No. 14).

The 240-acre Sandstone Research Natural Area is located in Section 12 in the southwest quarter of the Refuge, just south of Sprague-Mather Road. It is designated a Kuchler K18 Oak Savanna type ecosystem. Fire is an integral part of the management of this area with prescribed burning done about once every 5 years.

On January 20, 1987, two more areas on the Refuge were approved for inclusion into the Natural Area Land Bank. The Tomezek Research Natural Area is a 100-acre area located in Section 20 (T20N, R3E) of the Refuge. The Sand Ridge Public Use Natural Area is a 74-acre area located in Section 18 (T20N, R3E) of the Refuge. All types of land manipulation are withheld from these two areas.

It should be noted that lands within the legislative boundaries of the Refuge were reviewed for wilderness suitability as part of the CCP process. No lands were found suitable for designation as Wilderness as defined in the Wilderness Act of 1964. The Refuge does not contain 5,000 contiguous roadless acres nor does the refuge have any units of sufficient size to make their preservation practicable as designated Wilderness.

Land Acquisition
Currently there is no active land acquisition occurring at the Refuge. However, with the completion of this CCP/EA, the Refuge will be positioned to acquire conservation easements and fee-title interests in lands from willing sellers within the Yellow River Focus Area (willing seller only)(Figure 11). The Yellow River Focus Area project provides a unique opportunity for the Refuge to assist in the restoration and preservation of rare and declining bottomland forest and adjacent upland habitat for the benefit of migratory birds, threatened and endangered species, and public recreation and environmental education. Many landowners within this 21,953-acre area have approached the Refuge in recent years in search of technical assistance and/or to sell an interest in their land. In response to this demand, the Refuge competed for and won two sizable

grants to provide technical assistance to private landowners in the area. In the past two years alone, 121 landowners owning 17,308 acres have received technical assistance from the Service in managing their land. Interest in preserving this important natural area is high among landowners, local residents, conservation organizations, and state and local governments.

Funding for land acquisition (conservation easements and fee-title purchases) will come from the Land and Water Conservation Fund, using the authority of the Fish and Wildlife Act of 1956. However, no funding for land acquisition is currently available, and no money was requested by the Service for either of the years 2000 or 2001. It is anticipated that the Service will request land acquisition funding for the YRFA for Fiscal Year 2003. All land acquisition by the Service will from willing sellers. All land acquired by the Service will be administered and managed by the National Wildlife Refuge System, Necedah National Wildlife Refuge. Additional information on Service land acquisition policies and procedures can be found in the attached EA, and at the Service's Internet site at *www.fws.gov*.

3.5 Monitoring and Studies

The support and implementation of scientifically rigorous monitoring and research creates a foundation for quality management decisions at the Refuge.

Surveys and Censuses
Each year, beginning in August, Refuge staff band approximately 1,000 ducks to assess population levels and monitor migration patterns through band returns and band recaptures. Other species that have been banded in the past include: woodcock, red-winged blackbirds, black-capped chickadees, white-breasted nuthatches, upland sandpipers, blue jays, eastern towhees, brown thrashers, vesper sparrows, bay-breasted warblers, brown-headed cowbirds, Cooper's hawks, Canada geese, rose-breasted grosbeaks, white-throated sparrows, white-crowned sparrows, Brewer's blackbirds, barn swallows, fox sparrows, and sandhill cranes.

The Refuge also participates in several national, regional, and local wildlife surveys. These include spring waterfowl breeding pair surveys, fall waterfowl surveys, sandhill crane fly-out surveys, mourning dove coo surveys, woodcock surveys, fall sandhill crane roost surveys, songbird point counts, Karner blue butterfly surveys, wolf howling surveys, wolf tracking surveys, and massasauga rattlesnake population surveys. Data from several of the bird surveys are pooled with other national and regional data to determine population trends for the species. The population trends are then used to set harvest limits for states where these species are hunted.

Studies and Investigations
The Refuge also participates in numerous regional studies in partnership with other government agencies and/or universities, with graduate students and faculty from the University of Wisconsin (Stevens Point and Madison campuses) being the most numerous. However, graduate students and faculty from Bowling Green University (Ohio), the University of Michigan, Ripon College (Wisconsin), the University of Wisconsin-Platteville, and Ohio State University have all

participated in research activities on the Refuge. Staff from the U.S. Forest Service, National Park Service, the Wisconsin DNR, and U.S. Fish and Wildlife Service have conducted research on the Refuge. Research topics have included the ecology of oak wilt in savannas, invertebrate inventories, and bluebird nesting success studies, to name a few.

The Refuge currently takes part in a wide variety of monitoring and research projects. Most activities center around determining the effects of Refuge management actions on songbirds, savanna habitats, and species associated with savannas, although water quality issues are becoming higher research and monitoring priorities. Management activities currently being monitored include prescribed burning, water level manipulations, and forestry practices.

The Refuge also conducts studies to determine the effects of prescribed burning and savanna restoration on plant communities and their associated bird species. Many of the Refuge's research and management efforts have been supported by private organizations. These organizations include Ducks Unlimited, the Milwaukee County Zoo, the National Fish and Wildlife Foundation, The Sand County Foundation, the Prairie Chicken Society, and the Wisconsin Waterfowl Association.

In recent years, the Refuge has dedicated a substantial amount of research effort toward the Karner blue butterfly. Refining monitoring methods for this butterfly, determining the effects of Refuge management activities on the species, and determining the butterfly's dispersal ability, have been and will continue to be major research efforts.

The Refuge has also studied a variety of turtles including the Blanding's, softshell, painted and snapping turtle. Hognose, smooth green, garter, and the eastern massasauga rattlesnake are among the snake species that have been studied on the Refuge and in the Yellow River area. The Refuge has done several surveys for insects and spiders. There have been no surveys for other invertebrate groups on the Refuge. Bald eagle nest are monitored for success rates.

In 1999, 15 massasauga rattlesnakes that were reared in captivity were radio-marked and temporarily released into two closed areas of the Refuge. The purpose of the study is to determine survival, habitat use, dispersal, and home range information for the radio-marked snakes. Snakes will be monitored until mid-May 2001, at which time all surviving snakes will be captured and returned to educational institutions. No attempt to reestablish massasauga rattlesnake populations on the Refuge will occur without future public input.

3.6 Coordination Activities

Cooperative working relationships with other Federal agencies, the State of Wisconsin, universities, elementary and secondary educational institutions, and non-government organizations are key assets to the Refuge's success.

Interagency Coordination

The U.S. Geological Survey (USGS Upper Mississippi Science Center) has assisted the Refuge with research on massasauga rattlesnakes, which are endangered in the State of Wisconsin and a candidate species for Federal listing. Similarly, Refuge staff have cooperated with USGS staff at the Indiana Dunes National Lake Shore conducting Karner blue butterfly research and invertebrate inventories on restored savannas. The Refuge is currently working with USGS to create maps for the Refuge (GIS support).

The Department of Army (Fort McCoy) and the U.S. Forest Service (Huron, Manistee, and Chequamegon National Forests) are Federal cooperators involved with Karner blue butterfly research and savanna restoration efforts. The U.S. Forest Service also conducts national forest inventories on Refuge land.

The U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS) assist Refuge staff in providing technical assistance to landowners interested in restoring wetlands on their property through the Service's Private Lands Program. Refuge staff also work with NRCS staff on Farm Bill issues (Swampbuster violations and wetland delineations) and administration of the Wetland Reserve and Conservation Reserve Programs. The U.S. Army Corps of Engineers and the Wisconsin DNR are also cooperators on Farm Bill issues and wetland determinations.

The Central Wisconsin Basin Partnership (Partnership) is a Wisconsin DNR-coordinated group of agencies, private organizations, university faculty, and others interested in natural resource management. The Partnership chooses projects that support land and water resource management priorities within Juneau, Adams, Wood, and Portage counties. Support for the Partnership comes from endorsement of projects, networking with individual partners to achieve project goals, and financial assistance with projects from the Wisconsin DNR. The Refuge brought its interest in working with private landowners within the Yellow River Focus Area to the Partnership in 1998. As a result, the Yellow River has been adopted by the Partnership as the focus of a regional management effort that includes the Refuge=s Yellow River Focus Area and lands south of Necedah to the Wisconsin River, including Buckhorn State Park and the newly acquired Wisconsin DNR lands adjacent to the park.

Management of portions of the Necedah Wildlife Management Area (Figure 3) was transferred to the State of Wisconsin on June 29, 1940, with the signing of a Cooperative and License Agreement. The area is currently managed by the Wisconsin DNR under a 15-year extension of the original agreement granted in 1990. In addition to the Cooperative and License Agreement, the Refuge has a Memorandum of Understanding with the State that transfers management of the portion of the Refuge north of Finley Road to the Wisconsin DNR in exchange for a block of the Necedah Wildlife Management Area south of Grand Dike Road.

Other cooperative efforts involving the Wisconsin DNR include:

- Three State Natural Areas (areas set aside for their unique natural features, forest health and inventory efforts)
- Karner Blue Butterfly Habitat Conservation Plan
- Technical assistance with Karner blue butterfly and other endangered species issues
- Coordination efforts (comments on Hardwood Bombing Range issues)
- Butterfly and moth inventories (gypsy moth inventories)
- Weather data collection
- Suppression and control assistance with wild and prescribed fires
- Air quality monitoring using aspen plots

Tribal Coordination

Tribal coordination primarily occurs through the Refuge's Private Lands Program. Private Lands biologists have worked cooperatively with Ho-Chunk Nation members on four wetland and upland habitat restoration projects in Juneau, Monroe, LaCrosse, and Richland counties. The Refuge will continue to coordinate with Tribes as opportunities arise.

Necedah National Wildlife Refuge

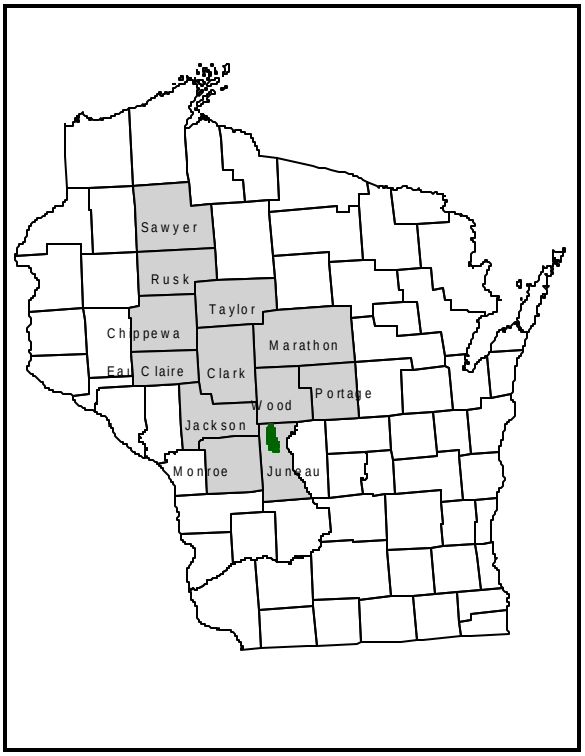

Figure 12 - Necedah NWR Private Lands District. Since 1986 Refuge staff have restored over 400 wetland basins on private lands within the 12-county district.

Private Lands Activities

The Refuge and its cooperating partner, the Wisconsin DNR, have focused considerable effort over the past few years on encouraging and assisting private landowners in restoring converted and degraded wetlands and associated upland habitats through private land efforts.

The Refuge's Partners for Fish and Wildlife Program provides technical assistance and cost-sharing to complete the work if the landowner agrees to maintain the area for a period of 10-years or more. The program focuses on restoring and enhancing habitats that provide wildlife, fisheries, water quality, aesthetic, and recreation benefits. Participation in this program is voluntary. In a 12-county area (Figure 12), 400 wetland basins totaling 1,824 acres have been restored since 1986.

Interest in the Partner's for Wildlife Program and wetland restoration remains high. Requests for restoration and

technical assistance averages over 200 annually. At current funding levels, Refuge private lands staff anticipate completing 25 restorations per year in the 12-county area of responsibility. Approximately $150,000 has been spent by the Refuge Private Lands program to benefit waterfowl, shorebirds, and grassland birds on private land. Approximately $700,000 is needed to complete all restoration requests from private landowners. Predictions for future demand for wetland restorations on private land within the district remain high. The Refuge's Partners for Fish and Wildlife Program is one of the Refuge's most successful outreach tools.

Refuge staff also protect, restore, and manage habitat within the Necedah Refuge Management District, which is a 17-county area in central and north central Wisconsin (Figure 13). The Necedah Refuge Management District is an area where the Refuge has established Conservation Easements on private land that protect wetlands and other sensitive habitats from development through deed restrictions. There are currently 41 Conservation Easements totaling 2,475 acres in 11 of the 17 counties, with another 4 easements with 418 acres waiting to be finalized. Wetland restorations have been completed on several of these easements; old farm fields have been seeded to permanent cover; boundaries have been posted, and fencing has been constructed as needed to restrict cattle grazing. Management plans will be developed for these areas to ensure protection and enhancement of the land.

Cooperative Events/Friends Organizations

One of the Refuge's most successful cooperative events is the Wisconsin Federal Junior Duck Stamp Program. Brochures are sent to over 2,900 public, private, and home schools statewide. Students from kindergarten through high school create original drawings or paintings of North American waterfowl and their surroundings and submit them for judging. The Wisconsin Best of Show winner moves on to the national competition. A display of winning entries travels to throughout the state for public viewing.

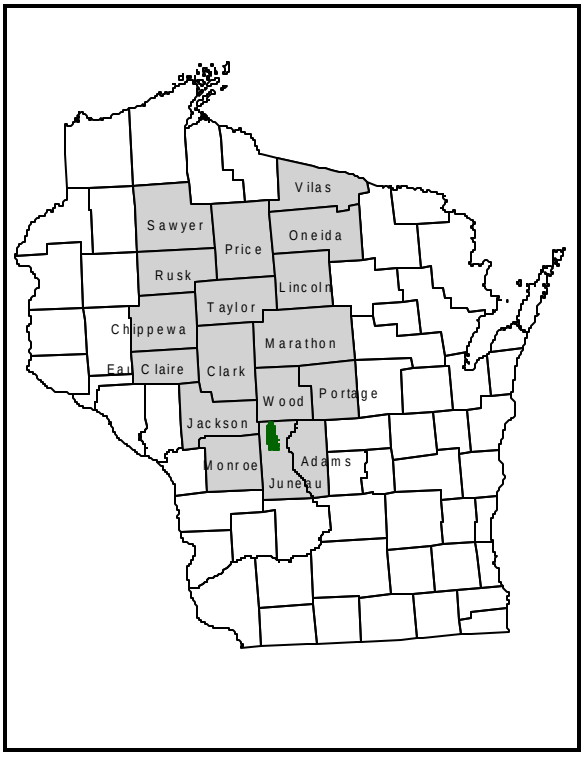

Figure 13 - Necedah Refuge Management District (17 counties).

3.7 Public Recreation and Education

Providing recreational opportunities and educating and interpreting the unique natural features of the Refuge for visitors are important elements of the Service's mission and the goals and objectives of the Refuge. In the National Wildlife Refuge Improvement Act of 1997, six wildlife-dependent recreational uses were determined priority public uses on national wildlife refuges. These are: hunting, fishing, wildlife observation, photography, environmental education and interpretation. These six uses, when compatible with the Refuge purpose, are the focus of the Refuge's public use activities.

Recreation

Hunters have been primary supporters of the Refuge since its creation in 1939. However, as a migratory bird refuge, the Refuge has a large percentage of its managed pools closed to hunting during fall bird migration. One large pool, Suk-Cerney, receives substantial waterfowl hunting use and also has a universally accessible waterfowl hunting blind. The Refuge's hunting brochure provides information on seasons, open and closed areas, and Refuge regulations.

Refuge visitors participate in hunting small game, migratory birds, and deer in designated areas. Hunters pursue ruffed grouse, wild turkey, and all migratory game birds with the exception of sandhill cranes. Dogs can be used when hunting small game and migratory birds. No permit or quota system is used to regulate the number of hunters on the Refuge or the number of birds killed. However, the take of all these species is regulated by state and Federal law. Ring-necked pheasant, northern bobwhite, and sharp-tailed grouse are not hunted on the Refuge due to low population numbers. The Refuge currently does not hold any special hunts, but offers opportunities for hunters with disabilities. Nearly 10,500 visits were made to the Refuge in 1999 for the purpose of hunting.

Recreational fishing is a popular pastime on the Refuge. In 1999, over 3,500 fishing visits were made to the Refuge for the purpose of fishing. The Refuge promotes recreational fishing by hosting annual National Fishing Day events. Activities for past National Fishing Days have included a children's fishing contest with prizes donated by area businesses, a "create a fish" art contest, and presentations by local fishing professionals. Most Refuge pools are managed as resting and feeding sites for migratory birds - which means that water levels are lowered every third year in each pool. This limits management for desirable fish species that inhabit the Refuge, such as northern pike, large mouth bass, bluegill, yellow perch, and black crappie.
Anglers fish the Refuge in accordance with state regulations. The Refuge's fishing brochure provides information on seasons, open and closed areas, and other Refuge-specific regulations. The Refuge is developing a fishing pier and a trail around Harvey's Pond to promote quality fishing opportunities.

Wildlife observation, including the observation of plants and other natural features, is the single most popular recreational use of the Refuge, with over 116,000 visits made in 1999. The Refuge is a designated watchable wildlife site and has a wildlife viewing "hot spots" brochure that highlights the most productive wildlife viewing areas, including the Rynearson Wetlands Observation Tower and Trail, the Pair Ponds Trail, and the Lupine Loop.

Photography is another popular public use related to wildlife observation. Visitors often take advantage of the Refuge's observation tower, observation platforms, and photo blind to capture special moments of nature's beauty. The photo blind is a place where wildlife observers can get up-close views and pictures of waterfowl, eagles, coyotes, and other wildlife species. Almost 20,000 visits were made to the Refuge in 1999 to photograph wildlife and nature.

Education, Interpretation, and Outreach

Environmental education, interpretation, and outreach are important tools that Refuge staff use to inform, persuade, and remind the public about Refuge issues and opportunities, such

Each year the Refuge reaches over 300,000 people through its environmental education and interpretation efforts (both on-site and off-site)

as bird migrations, special events, or to call attention to Refuge resources, such as rare oak savanna or threatened and endangered species such as the Karner blue butterfly. Refuge staff participate in education, interpretation, and outreach efforts both on and off the Refuge, and it is the way the Refuge makes contact with the public. Refuge staff give slide shows, lead interpretive tours and hikes, create educational exhibits, conduct activities and contests that offer hands-on learning opportunities, provide demonstrations and workshops, write educational articles, and give informational interviews. There are over 20 interpretive kiosks and signs on the Refuge to enhance visitor education and enjoyment. Over 300,000 people are reached through the Refuge's environmental education and interpretation efforts annually (both on-site and off-site, excluding media).

Refuge education, interpretation, and outreach programs focus on assisting youth and adults with becoming more environmentally literate and action oriented. Five primary functions or goals provide the framework for these goals: creating environmental awareness, knowledge, values, skills, and action. Because environmental education is part of a formal, structured method of teaching, there is an opportunity to work with people over several years. Programs are typically structured to begin with awareness in earlier years, and move through the higher goals in succeeding years. Interpretation on the other hand is more of an informal method of teaching directed at casual audiences, such as individuals or families who take part in programs on their own initiative, rather than part of a structured program. Interpretative programs often focus on awareness and knowledge, in a fun and thought-provoking manner. Refuge outreach consists of communication with internal and external publics using a variety of different mediums aimed at specific communication tasks designed to inform, persuade, or remind. Refuge outreach goals aim to build a stronger base of public understanding, appreciation, and support of the Refuge, National Wildlife Refuge System, and Service trust resources beyond that portion of the American public that visits the Refuge.

Refuge staff recognize the crucial link between public awareness and understanding of environmental issues and effective stewardship of the Refuge, the National Wildlife Refuge System, and Service trust resources. Currently Refuge education, interpretation, and outreach programs focus on the following target audiences as directed by the Service's *100 by 100 Outreach Campaign:*

- Congress
- Conservation Organizations
- Communities surrounding the Refuge, with a focus on school-age children and their educators, Yellow River landowners, and local residents.
- Communications media
- Corporations

Some of the more popular environmental education, interpretation, and outreach activities and tools the Refuge utilizes include:

- Wildlife Signs slide show
- Reptiles and amphibians of Wisconsin presentations
- Educator workshops
- Waterfowl banding workshops

- Radio telemetry demonstrations
- Guided hikes highlighting major Refuge themes
- Wolf awareness programs
- National Fishing Day events
- Earth Day activities
- Yellow River landowner technical support (through the Refuge's Private Lands Program)
- Print and broadcast media, including the Refuge's web page
- Volunteer programs, including the Refuge Friend's group
- Publications
- Over 20 interpretative kiosks and signs

In addition, three general theme will provide the focus for the Refuges education, interpretation, and outreach efforts:

The Necedah National Wildlife Refuge

- The Refuge as a "good neighbor"
- The Refuge as an enduring asset to the community
- The Refuge as a federal land base managed by the U.S. Fish and Wildlife Service

The National Wildlife Refuge System

- Refuges are part of a national system of refuges comprising the worlds largest collection of land and water managed specifically for wildlife
- Refuges are national treasures
- Refuges are places where wildlife come first

Service Trust Resources

- Listed species management (e.g., Karner blue butterflies, eastern massasauga rattlesnake, gray wolves, whooping crane, and bald eagles).
- Waterfowl and other migratory bird management (e.g., providing resting, nesting, and feeding habitat for wetland, open landscape, and forest species of concern).
- Ecosystem management (e.g., wetland, open landscape, and forest ecosystems) with a focus on restoration and management of sedge meadows, savannas, bottomland forests, and native biological diversity.
- The Yellow River as an exception natural resource and a place worth conserving.

3.8 Planning and Administration

Step-down Management Plans
Step-down management plans are an important component of Refuge management. These detailed plans serve as guiding documents for the day-to-day operation of the Refuge. Step-down management plans differ from CCPs in that they provide more detail relative to Refuge management subjects (e.g., habitat management, public use, fire, safety) or groups of related subjects. In many cases, step-down management plans will serve as an implementation tool to

describe specific strategies and implementation schedules for meeting CCP goals and objectives. In other cases, step-down plans provided the general framework for developing the CCP (the Refuge's Forest Management Plan helped affirm future management direction for forest land and savannas on the Refuge). The following plans are currently utilized and/or will be developed in support of the goals and objectives set forth in this document, either in their current or updated form.

Step-Down Plan	Last Revised	Current Status
Refuge Management Plan, Parts 1 &2	01/05/87	Replaced by the CCP
Refuge Management Plan, Part 3	09/15/89	Replaced by the CCP
Forest Management Plan	07/29/94	Review
Marsh and Water Management Plan	06/24/92	Review
Cropland Management Plan	11/24/86	Review and revise
Grassland Management Plan	05/03/88	Review and revise
Fire Management Plan	01/06/87	Review and revise
Public Use Plan	12/05/79	Review and revise
Sign Plan	02/17/88	Review and revise
Law Enforcement Plan	01/07/86	Review and revise
Fur Management Plan	03/11/88	Review and revise
Disease Contingency Plan	07/24/87	Review and revise
Integrated Pest Management Plan	---	To be developed

General Administration

Many administrative functions support the operation and maintenance of the Refuge. These include payroll, accounting, budgeting, procurement, acquisition, contracting, and planning. Some of these functions were formerly handled at the Regional Office in Minnesota. With Regional Office staff downsizing in the early 1990s, a greater amount of this activity was shifted to field stations, including this Refuge. It is anticipated that the complexity of the administrative support function will continue to increase.

Maintenance of the Refuge infrastructure includes 13 buildings, 62 water control structures, 6 bridges, over 20 miles of dikes, and more than 20 miles of roads that need regular maintenance. There are over 35 miles of boundaries to maintain, as well as decks, towers, trails, signs, and parking areas. Maintenance of some of these facilities has fallen behind due to inadequate personnel and funding.

3.9 Work Force

The ultimate success of the Refuge in carrying out its mission depends on staffing patterns and funding levels. Staff support is provided by a Regional Office in Fort Snelling, Minnesota; an Ecological Services Field Office in Green Bay, Wisconsin; a Fisheries Field Office in LaCrosse, Wisconsin; a Private Lands Office in Madison, Wisconsin; and a National Office in Washington, D.C.

Necedah National Wildlife Refuge

Current Refuge Work Force

Refuge Manager GS-485-13	1.0 FTE (full time equivalent)
Refuge Operations Specialist GS-485-12	1.0 FTE
Refuge Operations Specialist GS-485-11	1.0 FTE
Biologist GS-486-11	1.0 FTE
Park Ranger GS-025-09	.6 PPT (permanent part time)
Park Ranger GS-025-05	.6 PPT
Fire Management Officer GS-460-11	1.0 FTE
Biological Technician GS-404-07	1.0 FTE
Biological Technician GS-404-06	1.0 FTE
Forestry Technician GS-462-04	.35 TFT (temporary full time)
Administrative Technician GS-303-07	1.0 FTE
Maintenance Mechanic WG-4749-10	1.0 FTE
Equipment Operator WG-5716-08	1.0 FTE